AN 1999:317341 HCAPLUS
DN 130:355225
TI Iron alloy chisels for crushing refractories showing high resistance to settling, crack generation, and wear at high temperature
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PA Nippon Steel Corp., Japan; Daido Steel Co., Ltd.
SO Jpn. Kokai Tokkyo Koho, 6 pp.
CODEN: JKXXAF
DT Patent
LA Japanese
FAN.CNT 1

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	JP 11131193	A2	19990518	JP 1997-314541	19971031
PRAI	JP 1997-314541		19971031		

AB The chisels are made of **Fe** alloys containing **C** 0.20-0.60, **Si** <0.80, **Mn** 0.1-2.0, P ≤0.020, S ≤0.030, **Cr** 2.0-9.0, **Mo** 0.10-6.0, **W** 0.10-6.0, and **V** 0.01-2.5 weight%. The **Fe** alloys may further contain (A) Nb 0.01-1.5, Ta 0.01-1.5, Zr 0.01-1.5, Hf 0.01-1.5, Ti 0.01-1.5, Sc 0.001-1.5, and/or Y 0.001-1.5, and.or (B) Co 1.0-10.0, Ni 0.01-2.0, Cu 0.25-1.0, B 0.001-0.050, and/or REM 0.001-0.60 weight%.

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-131193

(43)Date of publication of application : 18.05.1999

(51)Int.Cl. C22C 38/00
C21B 7/14
C22C 38/38
C22C 38/58

(21)Application number : 09-314541

(22)Date of filing : 31.10.1997

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(54) CHISEL FOR REFRACTORY CRUSHING

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a chisel for refractory crushing, excellent in fatigue strength, fatigue failure, wear resistance, etc., particularly at high temp.

SOLUTION: This chisel for refractory crushing has a composition consisting of, by weight, 0.20-0.60% C, <0.8% Si, 0.1-2.0% Mn, ≤0.020% P, ≤0.030% S, 2.0-9.0% Cr, 0.10-6.0% Mo, 0.10-6.0% W, 0.01-2.5% V, and the balance Fe with inevitable impurities.

LEGAL STATUS

[Date of request for examination] 30.07.2004

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of

rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] The chisel for refractories crushing by which it is consisting [the C:0.20 to 0.60 (below same)% / less than / Si:0.80% /, Mn:0.1-2.0%, P:0.020% or less, S:0.030% or less, Cr:2.0-9.0%, Mo:0.10-6.0%, W:0.10 - 6.0%, and V:0.01 to 2.5% / of the remainder Fe and an unescapable impurity]-by weight % characterized.
[Claim 2] C:0.20 - 0.60%, less than [Si:0.80%], Mn:0.1-2.0%, P:0.020% or less, S:0.030% or less, Cr:2.0-9.0%, Mo: 0.10-6.0%, W:0.10 - 6.0%, V:0.01 - 2.5%, And Nb:0.01-1.5%, Ta:0.01-1.5%, Zr:0.01-1.5%, Hf: 0.01-1.5%, Ti:0.01-1.5%, Sc:0.001-1.5%, and Y:0.001 - 1.5% of one sort or two sorts or more, the remainder: The chisel for refractories crushing characterized by consisting of Fe and an unescapable impurity.
[Claim 3] C:0.20 - 0.60%, less than [Si:0.80%], Mn:0.1-2.0%, P:0.020% or less, S:0.030% or less, Cr:2.0-9.0%, Mo: 0.10-6.0%, W:0.10 - 6.0%, V:0.01 - 2.5%, And one sort (Co:1.0-10.0%, nickel:0.01-2.0%, Cu:0.25-1.0%, B:0.001 - 0.050%, and REM:0.001-0.60%) or two sorts or more, the remainder: The chisel for refractories crushing characterized by consisting of Fe and an unescapable impurity.
[Claim 4] C:0.20 - 0.60%, less than [Si:0.80%], Mn:0.1-2.0%, P:0.020% or less, S:0.030% or less, Cr:2.0-9.0%, Mo: 0.10-6.0%, W:0.10 - 6.0%, V:0.01 - 2.5%, And Nb:0.01-1.5%, Ta:0.01-1.5%, Zr:0.01-1.5%, Hf: 0.01-1.5%, Ti:0.01-1.5%, Sc:0.001-1.5%, Y:0.001 - 1.5% of one sort, or two sorts or more -- further -- Co: -- 1.0 to 10.0% nickel: One sort (0.01-2.0%, Cu:0.25-1.0%, B:0.001 - 0.050%, and REM:0.001-0.60%) or two sorts or more, the remainder: The chisel for refractories crushing characterized by consisting of Fe and an unescapable impurity.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the chisel for refractories crushing suitable for crushing of refractories, such as ** for tapping of a shaft furnace, and a ladle, especially hot refractories (chisel).
[0002]
[Description of the Prior Art] ** for tapping of a shaft furnace lines the unshaped direct 3 inside the Parma refractories 2, as shown in drawing 1 , but since the pig iron and scoria which were fused flow to this **, the unshaped direct 3 lined inside is worn out, or it deteriorates chemically. Moreover, since cooling and heating are repeated by the change of tapping etc., this unshaped direct 3 deteriorates also by this. The slag line section 4 and the metal line section 5 are large, as shown in drawing 1 , the unshaped direct which deteriorated when the refractories of these parts became thin is crushed, dismantling removal is carried out, and this wear and degradation line the new unshaped direct 3 inside ******** 1.
[0003] Crushing of these refractories that deteriorated attaches a chisel 6 at the tip of the breaker of dismantling equipment as shown in drawing 2 , and is performed by moving this chisel 6 up and down. There are a straight thing as there is a thing of various configurations in this chisel 6 and shown also in a of drawing 3 or the configuration of that point, a thing made thin from the middle of a straight thing as shown in b, a thing made into the shape of a taper as shown in c, a thing (refer to Japanese-Patent-Application-No. 8-No. 91257 official report) which made the triangle the point [as] shown in d.
[0004] The chisel for this former and refractories crushing is JIS. SCM440 (P, S;<=0030% [C:0.38 - 0.43%, Si:0.15-0.35%, Mn:0.60-0.85%,], Cu:<=0.30%, nickel:<=0.25%, Cr:0.90-1.20%, Mo:0.15-0.30%, remainder Fe) It was used and manufactured. However, when this chisel for refractories crushing was used at the elevated temperature, its wear was large, and since the tip deformed, or deflection generated the thing of a configuration in the point as shown in b of above-mentioned drawing 3 , it was not able to be used at an elevated temperature for a long time.
[0005] C:0.20 - 0.85% which is similar to a Provisional-Publication-No. 61-No. 213349 official report with the component presentation of this invention on the other hand, Si: Less than [2.0%] (in the case of the tool steel between heat 0.80 - 1.50%), Mn:0.1-2.0%, P:0.020% or less, S:0.0030% or less, Cr:2.0-15.0%, And 1 of Mo:0.10-6.0%, W:0.10 - 6.0%, and V:0.01 - 2.5% of sorts and two sorts or more are included. Furthermore, the need is accepted. REM:0.001-0.60%, Nb:0.01-1.5%, Ta: 0.01-1.5%, Zr:0.01-1.5%, Hf:0.01-1.5%, Ti: 0.01-1.5%, Sc:0.001-1.5%, Y:0.001 - 1.5%, Co: 0.01-10.0%, nickel:0.01-2.0%, Cu:0.01-2.0%, one of B:0.001 - 0.050 etc.% etc. of sorts -- or two or more sorts are included, and it consists of remainder:Fe and an unescapable impurity, and is used as materials, such as a tool between the colds, a tool between heat, metal mold, and cutters, and alloy tool steel is indicated. However, the alloy tool steel of this official report is not a thing supposing a special application like the chisel which Si content has increased in the tool steel between heat, and crushes hot refractories.
[0006]
[Problem(s) to be Solved by the Invention] This invention makes it the technical problem to offer the chisel for refractories crushing which was especially excellent in the setting nature in an elevated temperature, crack nature, abrasion resistance, etc.
[0007]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the chisel for refractories crushing of this invention The chemical entity presentation of the quality of the material C:0.20 -

0.60%, less than [Si:0.8%], Mn: 0.1-2.0%, P:0.020% or less, S:0.030% or less, Cr: 2.0-9.0%, Mo:0.10-6.0%, W:0.10 - 6.0%, The need is further accepted including V:0.01 - 2.5%. Nb:0.01-1.5%, Ta: 0.01-1.5%, Zr:0.01-1.5%, Hf:0.01-1.5%, Ti: 0.01-1.5%, Sc:0.001-1.5%, Y:0.001 - 1.5%, nickel: It is having considered as one sort or the thing which contains two or more sorts and consists of remainder:Fe and an unescapable impurity (0.01-2.0%, Co:1.0-10.0%, Cu:0.25-1.0%, B:0.001 - 0.050%, and REM:0.001-0.60%).
[0008]
[Function] Next, the reason for limitation of a component presentation of the chisel for refractories crushing of this invention is explained.
If it is an element effective in securing reinforcement required as a tool, hardness, and abrasion resistance, it is necessary to make it for C to combine with a carbide formation element C:0.20 to 0.60%, and to generate hard double carbide, and contain 0.20% or more in order to acquire such effectiveness, and contained so much, abrasion resistance will increase, but since toughness, forgeability, and workability fall, it may be 0.60% or less.

Si: Less than 0.8%Si is the element which can be made to be able to promote the deposit reaction of carbide and can achieve detailed-ization of carbide by containing more mostly as a deoxidizer than a complement while acting as a deoxidizer. Moreover, while strengthening a base, raising the yield point, while improving hardenability, and preventing scaling in high temperature, it is also an element effective in raising a fatigue limit. However, since the tool life by degradation of thermal conductivity and toughness arising will be shortened if contained so much, it may be less than 0.8%.
[0009] Mn: Since hot-working nature will fall if it is the element which improves hardenability, and it is necessary to make it contain 0.10% or more in order to acquire such effectiveness and is made to contain so much while Mn acts as . desulfurization and deoxidation material 0.1 to 2.0% and raising the cleanliness of steel, it may be 2.0% or less.
P:0.020%or less P is an impurity, is the element which increases generating of a streak flaw, and since it can improve heat-check-proof nature remarkably and can make the anisotropy of an impact resistance value quite small further, it may be 0.010% or less preferably 0.020% or less, while toughness is greatly improvable by reducing this content.
[0010] Since S:0.030%or less S is an impurity, can control generating of a streak flaw by reducing S content in steel and can raise an impact resistance value, it may be 0.030% or less.
Cr: Since it will deteriorate toughness and workability if it is an element effective in raising abrasion resistance and thermal shock resistance, it is necessary to make it contain 2.0% or more in order to acquire such effectiveness, and there is while 2.0-9.0%Cr combines with C, forms compound carbide and raises the reinforcement of a tool, especially high temperature strength, it may be 9.0% or less. [too much]
It is an element effective in Mo combining with C Mo:0.10 to 6.0%, and forming detailed compound carbide, and dissolving also to radical underground, strengthening the base concerned, increasing heat treatment hardness, and raising abrasion resistance. If many [in order to acquire such effectiveness, it is necessary to make it contain 0.10% or more, and / too], while toughness will fall, since big and rough carbide also increases in number and it has a bad influence on a fatigue property, it may be 6.0% or less.
[0011] While W:0.10 - 6.0%W combines with C, forms detailed compound carbide, and dissolves also to radical underground, strengthens the base concerned, increases heat treatment hardness and raises abrasion resistance By the element effective in lengthening a thermal fatigue life, if many [in order to acquire such effectiveness, it is necessary to make it contain 0.10% or more, and / too], while toughness will fall, since big and rough carbide also increases in number and it has a bad influence on a fatigue property on the contrary, it may be 6.0% or less.
V:0.01 - 2.5%V is an element effective in combining with C, forming detailed compound carbide, increasing heat treatment hardness, and raising abrasion resistance, and since its big and rough carbide also increases in number and it has a bad influence on a fatigue property on the contrary, it may be 2.5% or less, while toughness will fall, if many [in order to acquire such effectiveness, 0.01% or more is required, and / too].
[0012] Nb: 0.01-1.5%, Ta:0.01-1.5%, less than [Zr:0.01-1.5%], Hf:0.01-1.5%, Ti:0.01-1.5%, Sc:0.001-1.5%, and Y:0.001 - 1.5%Nb, and Ta, Zr, Hf, Ti, Sc and Y Carbide is formed, heat treatment hardness is increased, these elements are suitably chosen by the element effective in raising abrasion resistance if needed, and all are made to contain in the above-mentioned range.
[0013] Co: Each of REM(one-sort or two sorts or more of sum totals of rare earth elements):0.001 - 0.60%Co

(es), and nickel, Cu(s), B and REM are the elements which strengthen a base and raise reinforcement, shock resistance, and heat-check-proof nature, and they choose these elements suitably and make them contain them in the above-mentioned range 1.0-10.0%, nickel:0.01-2.0%, Cu:0.25-1.0%, and B:0.001 to 0.050%. Moreover, since B is an element effective in fixing N in steel in the form of BN, and losing the bad influence of N while raising the hardenability of steel, it is made to contain in the above-mentioned range if needed.

[0014] Since machinability besides the above-mentioned alloy element is improved, the chisel for refractories crushing of this invention can be made to contain one sort in less than [Pb:0.4%], less than [Bi:0.5%], and less than [Te:0.3%], or two sorts or more Mg:0.001-0.5% and calcium:0.002-0.01%. In addition, 0.020% or less of aluminum is [N of an impurity / 200 ppm or less and O] desirable 0.0030% or less.

[0015]

[Embodiment of the Invention] Next, an example explains this invention. After ingoting the ingredient of the chemical entity presentation shown in the following table 1 with the vacuum induction melting furnace, ingot making was carried out and the ingot was obtained. Next, annealing was performed after carrying out cogging of each of this ingot between heat. The chisel of the configuration (A type) of a of drawing 3 and the configuration (B type) of b of drawing 3 was created by machining from each ingredient which performed this annealing. These chisels were heat-treated on condition that the following.

The example of this invention (No.1-6)

Oil quenching is carried out from 1100 degrees C, air cooling is carried out from 570 degrees C after hardening, and it is an example of a tempering comparison (SCM440 of No.7 and the conventional example).

Oil quenching is carried out from 850 degrees C, oil quenching is carried out from 580 degrees C after hardening, and it is the example 2 (No.8, SKD61) of a tempering comparison.

Air cooling is carried out from 1025 degrees C, air cooling is carried out from 600 degrees C after hardening, and it is the example 3 (No.9, SKH51) of a tempering comparison.

Oil quenching is carried out from 1220 degrees C, air cooling is carried out from 560 degrees C after hardening, and it is annealing [0016].

[Table 1]

表 1

(wt%)

	No.	C	Si	Mn	P	S	Cr	Mo	W	V	その他
本発明例	1	0.59	0.01	0.35	0.015	0.002	4.60	3.88	1.87	1.00	
	2	0.60	0.30	0.36	0.009	0.004	4.58	3.90	1.90	1.05	
	3	0.47	0.04	0.35	0.010	0.003	8.75	4.30	4.20	2.30	Nb:0.25、Zr:0.30 、Y:0.05
	4	0.43	0.05	0.38	0.018	0.001	2.60	0.45	1.05	0.50	Co:10.0、Cu:0.50 、B:0.0.02
	5	0.30	0.02	0.30	0.008	0.002	7.50	5.45	0.20	0.05	REM:0.20 、Ni:0.65
	6	0.40	0.15	0.39	0.011	0.003	7.30	2.95	0.85	1.03	Nb:0.53、Co:3.25
比較例	7	0.40	0.25	0.70	0.012	0.003	1.00	0.23			
	8	0.37	1.00	0.25	0.014	0.002	5.00	1.25		1.00	
	9	0.85	0.35	0.30	0.009	0.004	4.10	5.00	5.10	1.90	

比較例のNo.7（従来例）：SCM440　比較例のNo.8：SKD61　比較例のNo.9：SKH51

[0017] Thus, the appearance when using it in the ordinary temperature degree of hardness of the manufactured chisel, toughness, and a 450-550-degree C temperature requirement for 2 hours was shown in the following table 2.

[0018]

[Table 2]

表　2

	No.	常温硬度 HRC	常温衝撃値 J(ジュール)	450～550℃で2時間使用後の外観					
				A タイプ			B タイプ		
				評価	割れ・ヒートクラック	その他	評価	曲がり・折損	その他
本発明例	1	52	2U 25	◎	なし		◎	なし	
	2	52	〃 25	◎	〃		◎	〃	
	3	52	〃 32	◎	〃		◎	〃	
	4	52	〃 35	◎	〃		◎	〃	
	5	52	〃 40	◎	〃		◎	〃	
	6	52	〃 35	◎	〃		◎	〃	
比較例	7	34	2v137	△	〃	先端変形大	×	曲がり発生	
	8	52	2U 44	△	〃		△	なし	先端摩耗大
	9	64	〃 4	△	ヒートクラック発生	欠け発生	×	折損発生	

摩耗量 ◎……少量の摩耗のみ　△……やや損傷　×……途中で使用不能
2U、2V：試験片の溝の深さおよび形状

[0019] From this result, even after all the things used it at 450-550 degrees C for 2 hours, the point was only slightly worn out, and the chisel of this invention broke, and did not have the damage on breakage etc. Deformation occurs [an A type thing] in a point, and deflection occurred in the point (part of 60phi), and it became impossible however, for a B type thing to use for it the chisel (example No7 of a comparison) manufactured by conventional SCM440 on the way. moreover -- although the chisel (example No.of comparison 8) manufactured by SKD61 which is the ****** tool steel of comparison material did not generate a heat crack, deflection, and breakage -- A type -- B type had large wear at a tip and wear at the tip of a B type thing was especially large. An A type thing has large wear, and a heat crack and a chip occur, and breakage occurred in the point (part of 60phi), and it became impossible moreover, for the chisel (example No.of comparison 9) manufactured by SKH51 which is the high-speed steel of comparison material to use a B type thing for it on the way.

[0020]

[Effect of the Invention] even if it uses the chisel for refractories crushing of this invention at an elevated temperature by having carried out the component presentation to the above-mentioned configuration -- anything of a configuration -- breakage -- and -- passing -- slack -- there are not only nothings, but there is also no generating of a crack and it does so the outstanding effectiveness that there is also little abrasion loss.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention] This invention relates to the chisel for refractories crushing suitable for crushing of refractories, such as ** for tapping of a shaft furnace, and a ladle, especially hot refractories (chisel).

[Translation done.]

PRIOR ART

[Description of the Prior Art] ** for tapping of a shaft furnace lines the unshaped direct 3 inside the Parma refractories 2, as shown in drawing 1 , but since the pig iron and scoria which were fused flow to this **, the unshaped direct 3 lined inside is worn out, or it deteriorates chemically. Moreover, since cooling and heating are repeated by the change of tapping etc., this unshaped direct 3 deteriorates also by this. The slag line section 4 and the metal line section 5 are large, as shown in drawing 1 , the unshaped direct which deteriorated when the refractories of these parts became thin is crushed, dismantling removal is carried out, and this wear and degradation line the new unshaped direct 3 inside ******** 1.

[0003] Crushing of these refractories that deteriorated attaches a chisel 6 at the tip of the breaker of dismantling equipment as shown in drawing 2 , and is performed by moving this chisel 6 up and down. There are a straight thing as there is a thing of various configurations in this chisel 6 and shown also in a of drawing 3 or the configuration of that point, a thing made thin from the middle of a straight thing as shown in b, a thing made into the shape of a taper as shown in c, a thing (refer to Japanese-Patent-Application-No. 8-No. 91257 official report) which made the triangle the point [as] shown in d.

[0004] The chisel for this former and refractories crushing is JIS. SCM440 (P, S;<=0030% [C:0.38 - 0.43%, Si:0.15-0.35%, Mn:0.60-0.85%,], Cu:<=0.30%, nickel:<=0.25%, Cr:0.90-1.20%, Mo:0.15-0.30%, remainder Fe) It was used and manufactured. However, when this chisel for refractories crushing was used at the elevated temperature, its wear was large, and since the tip deformed, or deflection generated the thing of a configuration in the point as shown in b of above-mentioned drawing 3 , it was not able to be used at an elevated temperature for a long time.

[0005] C:0.20 - 0.85% which is similar to a Provisional-Publication-No. 61-No. 213349 official report with the component presentation of this invention on the other hand, Si: Less than [2.0%] (in the case of the tool steel between heat 0.80 - 1.50%), Mn:0.1-2.0%, P:0.020% or less, S:0.0030% or less, Cr:2.0-15.0%, And 1 of Mo:0.10-6.0%, W:0.10 - 6.0%, and V:0.01 - 2.5% of sorts and two sorts or more are included. Furthermore, the need is accepted. REM:0.001-0.60%, Nb:0.01-1.5%, Ta: 0.01-1.5%, Zr:0.01-1.5%, Hf:0.01-1.5%, Ti: 0.01-1.5%, Sc:0.001-1.5%, Y:0.001 - 1.5%, Co: 0.01-10.0%, nickel:0.01-2.0%, Cu:0.01-2.0%, one of B:0.001 - 0.050 etc.% etc. of sorts -- or two or more sorts are included, and it consists of remainder:Fe and an unescapable impurity, and is used as materials, such as a tool between the colds, a tool between heat, metal mold, and cutters, and alloy tool steel is indicated. However, the alloy tool steel of this official report is not a thing supposing a special application like the chisel which Si content has increased in the tool steel between heat, and crushes hot refractories.

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EFFECT OF THE INVENTION

[Effect of the Invention] even if it uses the chisel for refractories crushing of this invention at an elevated temperature by having carried out the component presentation to the above-mentioned configuration -- anything of a configuration -- breakage -- and -- passing -- slack -- there are not only nothings, but there is also no generating of a crack and it does so the outstanding effectiveness that there is also little abrasion loss.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] This invention makes it the technical problem to offer the chisel for refractories crushing which was especially excellent in the setting nature in an elevated temperature, crack nature, abrasion resistance, etc.

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MEANS

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the chisel for refractories crushing of this invention The chemical entity presentation of the quality of the material C:0.20 - 0.60%, less than [Si:0.8%], Mn: 0.1-2.0%, P:0.020% or less, S:0.030% or less, Cr: 2.0-9.0%, Mo:0.10-6.0%, W:0.10 - 6.0%, The need is further accepted including V:0.01 - 2.5%. Nb:0.01-1.5%, Ta: 0.01-1.5%, Zr:0.01-1.5%, Hf:0.01-1.5%, Ti: 0.01-1.5%, Sc:0.001-1.5%, Y:0.001 - 1.5%, nickel: It is having considered as one sort or the thing which contains two or more sorts and consists of remainder:Fe and an unescapable impurity (0.01-2.0%, Co:1.0-10.0%, Cu:0.25-1.0%, B:0.001 - 0.050%, and REM:0.001-0.60%).

[Translation done.]

OPERATION

[Function] Next, the reason for limitation of a component presentation of the chisel for refractories crushing of this invention is explained.
If it is an element effective in securing reinforcement required as a tool, hardness, and abrasion resistance, it is necessary to make it for C to combine with a carbide formation element C:0.20 to 0.60%, and to generate hard double carbide, and contain 0.20% or more in order to acquire such effectiveness, and contained so much, abrasion resistance will increase, but since toughness, forgeability, and workability fall, it may be 0.60% or less.

Si: Less than 0.8%Si is the element which can be made to be able to promote the deposit reaction of carbide and can achieve detailed-ization of carbide by containing more mostly as a deoxidizer than a complement while acting as a deoxidizer. Moreover, while strengthening a base, raising the yield point, while improving hardenability, and preventing scaling in high temperature, it is also an element effective in raising a fatigue limit. However, since the tool life by degradation of thermal conductivity and toughness arising will be shortened if contained so much, it may be less than 0.8%.
[0009] Mn: Since hot-working nature will fall if it is the element which improves hardenability, and it is necessary to make it contain 0.10% or more in order to acquire such effectiveness and is made to contain so much while Mn acts as . desulfurization and deoxidation material 0.1 to 2.0% and raising the cleanliness of steel, it may be 2.0% or less.
P:0.020%or less P is an impurity, is the element which increases generating of a streak flaw, and since it can improve heat-check-proof nature remarkably and can make the anisotropy of an impact resistance value quite small further, it may be 0.010% or less preferably 0.020% or less, while toughness is greatly improvable by reducing this content.
[0010] Since S:0.030%or less S is an impurity, can control generating of a streak flaw by reducing S content in steel and can raise an impact resistance value, it may be 0.030% or less.
Cr: Since it will deteriorate toughness and workability if it is an element effective in raising abrasion resistance and thermal shock resistance, it is necessary to make it contain 2.0% or more in order to acquire such effectiveness, and there is while 2.0-9.0%Cr combines with C, forms compound carbide and raises the reinforcement of a tool, especially high temperature strength, it may be 9.0% or less. [too much]
It is an element effective in Mo combining with C Mo:0.10 to 6.0%, and forming detailed compound carbide, and dissolving also to radical underground, strengthening the base concerned, increasing heat treatment hardness, and raising abrasion resistance. If many [in order to acquire such effectiveness, it is necessary to make it contain 0.10% or more, and / too], while toughness will fall, since big and rough carbide also increases in number and it has a bad influence on a fatigue property, it may be 6.0% or less.
[0011] While W:0.10 - 6.0%W combines with C, forms detailed compound carbide, and dissolves also to radical underground, strengthens the base concerned, increases heat treatment hardness and raises abrasion resistance By the element effective in lengthening a thermal fatigue life, if many [in order to acquire such effectiveness, it is necessary to make it contain 0.10% or more, and / too], while toughness will fall, since big and rough carbide also increases in number and it has a bad influence on a fatigue property on the contrary, it may be 6.0% or less.
V:0.01 - 2.5%V is an element effective in combining with C, forming detailed compound carbide, increasing heat treatment hardness, and raising abrasion resistance, and since its big and rough carbide also increases in number and it has a bad influence on a fatigue property on the contrary, it may be 2.5% or less, while toughness will fall, if many [in order to acquire such effectiveness, 0.01% or more is required, and / too].

[0012] Nb: 0.01-1.5%, Ta:0.01-1.5%, less than [Zr:0.01-1.5%], Hf:0.01-1.5%, Ti:0.01-1.5%, Sc:0.001-1.5%, and Y:0.001 - 1.5%Nb, and Ta, Zr, Hf, Ti, Sc and Y Carbide is formed, heat treatment hardness is increased, these elements are suitably chosen by the element effective in raising abrasion resistance if needed, and all are made to contain in the above-mentioned range.
[0013] Co: Each of REM(one-sort or two sorts or more of sum totals of rare earth elements):0.001 - 0.60%Co (es), and nickel, Cu(s), B and REM are the elements which strengthen a base and raise reinforcement, shock resistance, and heat-check-proof nature, and they choose these elements suitably and make them contain them in the above-mentioned range 1.0-10.0%, nickel:0.01-2.0%, Cu:0.25-1.0%, and B:0.001 to 0.050%. Moreover, since B is an element effective in fixing N in steel in the form of BN, and losing the bad influence of N while raising the hardenability of steel, it is made to contain in the above-mentioned range if needed.
[0014] Since machinability besides the above-mentioned alloy element is improved, the chisel for refractories crushing of this invention can be made to contain one sort in less than [Pb:0.4%], less than [Bi:0.5%], and less than [Te:0.3%], or two sorts or more Mg:0.001-0.5% and calcium:0.002-0.01%. In addition, 0.020% or less of aluminum is [N of an impurity / 200 ppm or less and O] desirable 0.0030% or less.
[0015]
[Embodiment of the Invention] Next, an example explains this invention. After ingoting the ingredient of the chemical entity presentation shown in the following table 1 with the vacuum induction melting furnace, ingot making was carried out and the ingot was obtained. Next, annealing was performed after carrying out cogging of each of this ingot between heat. The chisel of the configuration (A type) of a of drawing 3 and the configuration (B type) of b of drawing 3 was created by machining from each ingredient which performed this annealing. These chisels were heat-treated on condition that the following.
The example of this invention (No.1-6)
Oil quenching is carried out from 1100 degrees C, air cooling is carried out from 570 degrees C after hardening, and it is an example of a tempering comparison (SCM440 of No.7 and the conventional example).
Oil quenching is carried out from 850 degrees C, oil quenching is carried out from 580 degrees C after hardening, and it is the example 2 (No.8, SKD61) of a tempering comparison.
Air cooling is carried out from 1025 degrees C, air cooling is carried out from 600 degrees C after hardening, and it is the example 3 (No.9, SKH51) of a tempering comparison.
Oil quenching is carried out from 1220 degrees C, air cooling is carried out from 560 degrees C after hardening, and it is annealing [0016].
[Table 1]

表 1

(wt%)

	No.	C	Si	Mn	P	S	Cr	Mo	W	V	その他
本発明例	1	0.59	0.01	0.35	0.015	0.002	4.60	3.88	1.87	1.00	
	2	0.60	0.30	0.36	0.009	0.004	4.58	3.90	1.90	1.05	
	3	0.47	0.04	0.35	0.010	0.003	8.75	4.30	4.20	2.30	Nb:0.25、Zr:0.30 、Y:0.05
	4	0.43	0.05	0.38	0.018	0.001	2.60	0.45	1.05	0.50	Co:10.0、Cu:0.50 、B:0.0.02
	5	0.30	0.02	0.30	0.008	0.002	7.50	5.45	0.20	0.05	REM:0.20 、Ni:0.65
	6	0.40	0.15	0.39	0.011	0.003	7.30	2.95	0.85	1.03	Nb:0.53、Co:3.25
比較例	7	0.40	0.25	0.70	0.012	0.003	1.00	0.23			
	8	0.37	1.00	0.25	0.014	0.002	5.00	1.25		1.00	
	9	0.85	0.35	0.30	0.009	0.004	4.10	5.00	5.10	1.90	

比較例のNo.7（従来例）：SCM440　比較例のNo.8：SKD61　比較例のNo.9：SKH51

[0017] Thus, the appearance when using it in the ordinary temperature degree of hardness of the manufactured chisel, toughness, and a 450-550-degree C temperature requirement for 2 hours was shown in the following

table 2.
[0018]
[Table 2]
表 2

	No.	常温硬度 HRC	常温衝撃値 J(ジュール)	450～550℃で2時間使用後の外観					
				A タイプ			B タイプ		
				評 価	割れ・ヒートクラック	その他	評 価	曲がり・折損	その他
本発明例	1	52	2U 25	◎	なし		◎	なし	
	2	52	〃 25	◎	〃		◎	〃	
	3	52	〃 32	◎	〃		◎	〃	
	4	52	〃 35	◎	〃		◎	〃	
	5	52	〃 40	◎	〃		◎	〃	
	6	52	〃 35	◎	〃		◎	〃	
比較例	7	34	2v137	△	〃	先端変形大	×	曲がり発生	
	8	52	2U 44	△	〃		△	なし	先端摩耗大
	9	64	〃 4	△	ヒートクラック発生	欠け発生	×	折損発生	

摩耗量 ◎……少量の摩耗のみ △……やや損傷 ×……途中で使用不能
2U、2V：試験片の溝の深さおよび形状

[0019] From this result, even after all the things used it at 450-550 degrees C for 2 hours, the point was only slightly worn out, and the chisel of this invention broke, and did not have the damage on breakage etc. Deformation occurs [an A type thing] in a point, and deflection occurred in the point (part of 60phi), and it became impossible however, for a B type thing to use for it the chisel (example No7 of a comparison) manufactured by conventional SCM440 on the way. moreover -- although the chisel (example No.of comparison 8) manufactured by SKD61 which is the ****** tool steel of comparison material did not generate a heat crack, deflection, and breakage -- A type -- B type had large wear at a tip and wear at the tip of a B type thing was especially large. An A type thing has large wear, and a heat crack and a chip occur, and breakage occurred in the point (part of 60phi), and it became impossible moreover, for the chisel (example No.of comparison 9) manufactured by SKH51 which is the high-speed steel of comparison material to use a B type thing for it on the way.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the mimetic diagram showing the faulted condition of ** for tapping of a shaft furnace.
[Drawing 2] It is the conceptual diagram showing the condition of crushing the damage part of ** for tapping of a shaft furnace by the chisel.
[Drawing 3] It is the front view and bottom view for explaining the configuration of various kinds of chisels.
[Description of Notations]
1 **
2 Parma Refractories
3 Unshaped Direct
4 Erosion of Scoria Line Section
5 Erosion of Metal Line Section
6 Chisel

[Translation done.]

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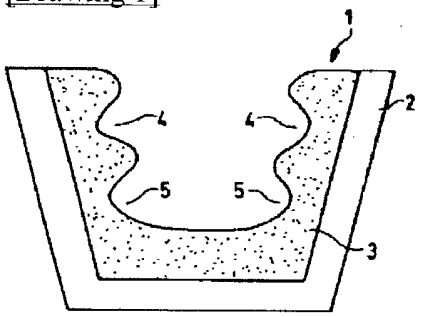
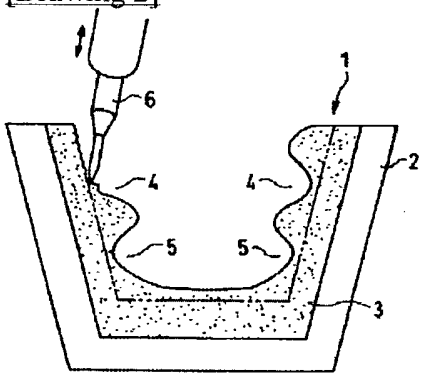
DRAWINGS

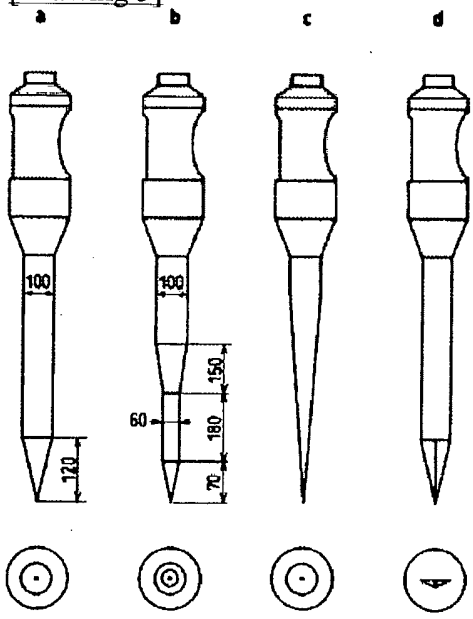
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]